

# Gas gangrene following perforation of the colon

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Gas gangrene secondary to perforation of the gastrointestinal tract is very unusual. A few single cases have been documented;<sup>1-4</sup> in addition, Warthen<sup>5</sup> reported three and Silver<sup>6</sup> four cases, three of which appear to have followed either instrumentation or surgery. All the cases seemed to be due to *Clostridium* infection. We report two cases of gas gangrene in nondiabetic patients, one associated with *Escherichia coli* infection and the second with both *C. welchii* and *E. coli* infection.

## Case reports

### Case 1

A 76-year-old man was brought to the hospital in obvious shock. He had had pain in the left iliac fossa for 2 weeks, and it had worsened during the previous 2 days. There was pink bruising over the left iliac fossa and part of the left flank, with crepitus in these areas. Roentgenograms of the abdomen (Fig. 1) led to a diagnosis of gas gangrene, and treatment was started with intravenously administered penicillin, clindamycin, gentamicin and fluids. At laparotomy the small bowel and sigmoid colon were found to be adherent to the anterior abdominal wall in the left lower quadrant, and there was a communication between an area of diverticular disease of the sigmoid colon and the abdominal wall, from which an abscess in the abdominal wall had formed. Postoperatively the patient's condition deteriorated, and the next day he died. Culture of pus from the abscess cavity and the necrotic muscle tissue yielded a heavy growth of *E. coli* and other coliforms. *Clostridium* was not demonstrated by either smear examination or culture.

### Case 2

Another man, 53 years old, had been ill with abdominal pain, vomiting and

fever for a week; when admitted to hospital he was in moderate septic shock. Twenty-one years earlier a gunshot wound in his right leg had resulted in gas gangrene, which had led to amputation above the knee. Now physical examination and roentgenography of the abdomen and the stump showed gas bubbles in the right iliac fossa and in the muscular and fascial planes (Fig. 2). We

made a diagnosis of retrocecal abscess, probably related to the appendix, with gas gangrene tracking into the thigh. Initial treatment was with intravenously administered penicillin, lincomycin, gentamicin and fluids. Laparotomy revealed perforation of the cecum associated with gross contamination of the retroperitoneum and necrosis of the psoas and thigh muscles. The appendix was normal. A right hemicolectomy was performed, along with débridement of the necrotic psoas muscle and disarticulation of the right hip. The patient recovered slowly and 2 years later was well.

The cause of the cecal perforation was never obvious, though an acute inflammatory reaction was noted by microscopic examination of the tissue around the perforation and presumably was at the site of a solitary diverticulum. Culture from the abdominal cavity and necrotic muscle yielded a heavy growth of *E. coli*, *C. welchii* and *Bacteroides*.

## Discussion

Most of the causative organisms of gas gangrene are found among the normal flora of the colon, and small numbers of *C. welchii* have been found in the stools of 25% to 35% of healthy people.<sup>7</sup> The presence in human feces of a proteolytic enzyme that can destroy the  $\alpha$ -toxin of *C. welchii* may render the organism nonpathogenic when it is confined to the gut.<sup>8,9</sup> However, one would expect infection to be readily established when the gut is ruptured, and it is surprising that this so rarely happens. Nonclostridial gas gangrene can be caused by any of *E. coli*, *Streptococcus*, *Proteus*, *Enterococcus*, *Staphylococcus*, *Klebsiella*, *Paracolon*, *Pseudomonas* and *Bacteroides* organisms.<sup>10</sup> *E. coli* is found in the large intestines of all normal humans,<sup>7</sup> and the factors that lead to infection with it are not clear. Conditions favourable for invasion by these organisms may prevail, perhaps, when another infection, a neoplasm or mechanical tissue damage has led to necrosis and perforation of the bowel, with local abscess formation. The infection may then spread to more distant parts and produce gas.

On clinical grounds gas gangrene is to

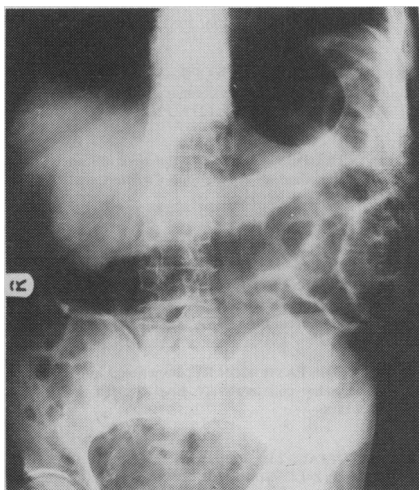


FIG. 1—Case 1: gas in muscle and subcutaneous planes of anterior and lateral abdominal walls in left flank, with a few gas-filled loops of small bowel in left lumbar region.

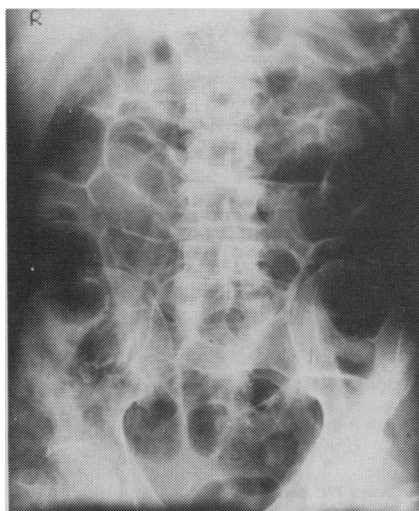


FIG. 2—Case 2: gas-dilated loops of small and large bowel, and gas translucencies in lumbar region and right iliac fossa, extending into thigh.

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be suspected when one is faced with increasing toxemia, cellulitis and crepitus. Diagnostic help may come from radiologic and bacteriologic examination. The situation is usually apparent when problems have developed after trauma or surgery. Early diagnosis is much more difficult, though, in concealed infections, when it may not be possible to get material for bacteriologic examination without surgery. Crepitation is not always present in the early stages, and usually by the time it has become obvious the toxemia is profound. Radiologically one sees progressive advance of the gas in the muscle bundles, visible as bubbles, pockets or streaks. It is best demonstrated in lateral views with the suspected area uppermost. Perforation of the bowel, however, may also give rise to intra- or extraperitoneal air

and local or generalized peritonitis.

When dealing with a gas gangrene infection one must distinguish among clostridial, nonclostridial and mixed infections, as the treatments differ. The antibiotic commonly used against *Clostridium* organisms may not be of much value in other kinds of gas gangrene, and hyperbaric oxygen has no effect in infections with *E. coli*.<sup>11</sup> Bacteriologic examination is essential for accurate diagnosis, and until the results of the cultures are known it is safer to use antibiotics effective against both clostridial and nonclostridial organisms.

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# Ovarian remnant syndrome

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Usually an ovary can be removed without difficulty. However, when it is attached to other pelvic organs or the pelvic wall some of the cortex may adhere to the peritoneal surfaces of those structures. The cortical tissue, which has been separated from its major blood supply, may undergo necrosis, cystic degeneration or neoplastic change, or it may remain functional, as experiments with cats have demonstrated.<sup>1</sup> The condition in which the detached ovarian tissue remains functional is called the ovarian remnant syndrome. This syndrome should be considered in all patients presenting with genitourinary symptoms or a pelvic mass following bilateral salpingo-oophorectomy, with or without hysterectomy, particularly in those with endometriosis or chronic pelvic inflammatory disease.

The ovarian remnant syndrome is considered rare; since 1962 only 22 cases have been reported.<sup>1-8</sup> However, some patients whose postoperative genitourinary symptoms have been attributed to adhesions, scarring from endometriosis or an inflammatory process may, in fact, have ovarian remnant syndrome.

Recently three patients at the Ottawa

Civic and Ottawa General hospitals have been found to have clinically and histologically confirmed ovarian remnant syndrome. In this paper we outline the signs and symptoms that may suggest this syndrome before surgical intervention and describe our way of managing such patients.

## Case reports

### Case 1

A 42-year-old woman underwent a laparotomy for lower abdominal pain and an adnexal mass. A right ovarian endometrioma was found and removed, and microscopic examination confirmed the clinical diagnosis of endometriosis. A year later she underwent a total abdominal hysterectomy and bilateral salpingo-oophorectomy because of increasing pain and dysfunctional uterine bleeding. Postoperatively she had no menopausal symptoms and refused hormone therapy. She remained well for 6 years, then presented with urinary frequency and urgency.

Physical examination revealed a large multicystic mass fixed to the left pelvic wall, and an intravenous pyelogram showed partial obstruction of the left ureter. At laparotomy a multiloculated cyst 8 cm in diameter was found in the mesentery of the sigmoid colon, mainly

in the retroperitoneal space. It was covered by the posterior peritoneum and was adherent to the bladder, the left ureter and the left pelvic wall. The cyst was dissected from its pelvic attachments and removed. A small part of the lining of the cyst was left attached to the mesenteric vessels so that the blood supply to the sigmoid colon would not be compromised. Histologic examination of the cyst revealed remnants of ovarian cortex and an endometriotic cyst.

Two years later the patient had no genitourinary symptoms, and a pelvic examination yielded no abnormalities.

### Case 2

A 34-year-old woman underwent total abdominal hysterectomy and bilateral salpingo-oophorectomy for severe endometriosis. Hormone therapy was given postoperatively but was stopped after 6 months because the symptoms had disappeared. The patient remained free of symptoms, including menopausal, for 5½ years, until she noted abdominal enlargement and urinary frequency and urgency. Urologic investigation, including cystoscopy, yielded no abnormalities, but the urinary symptoms worsened, and her abdomen continued to enlarge over the next 6 months.

Physical examination revealed a large tender cystic mass extending from the

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